CLAIMS

1. A method for automatically identifying tooth crowns in a virtual three-dimensional model of teeth in a dental arch, comprising the steps of:

a) storing said model in a memory accessible to a general-purpose computer, said computer including a processing unit;

b) providing machine readable instructions for execution by said processing unit, said instructions comprising instructions operating on said model in the following respects:

1) orientating said model with reference to a plane;

2) automatically determining local maxima of the model and areas bounded by said local maxima;

3) automatically determining saddle points between said local maxima in the model, said saddle points corresponding to boundaries between teeth;

4) determining the position of said saddle points along a dental archform, and

5) for each tooth, automatically identifying a path linking said saddle points comprising a transition between teeth and gingival tissue and between adjacent teeth in said model, and identifying areas bounded by said path and in the direction of said plane as corresponding to one of said tooth crowns.

2. The method of claim 1, wherein instructions 1) comprises instructions defining an occlusal plane or approximation thereof for the model and an approximate center of the model, and performing a transformation of said model to thereby orient

said model with reference to said occlusal plane or approximation thereof and to said center.

3. The method of claim 1, wherein, in instructions 4), said archform comprises a parabolic archform of the form $y = ax^2 + b$, and wherein the method further comprises the step of performing a parabolic coordinate transform to thereby determine parabolic x coordinates for said saddle points.

4. The method of claim 1, wherein said instructions 5) comprises instructions:

1) performing a directional ravine detection process testing for paths between saddle points with a concave curvature between two saddle points; and

2) delimiting an area bounded by said paths if said ravine detection process is successful.

5. The method of claim 1, wherein instructions 2), 3), 4) and 5) operate on a representation of said model comprising a continuous single surface formed of interconnected triangles defined by vertices.

6. A method for automatically identifying gingival tissue in a virtual three-dimensional model of anatomical structures of the teeth and associated gingival tissue in a dental arch, comprising the steps of:

a) storing said model in a memory accessible to a general-purpose computer, said computer including a processing unit;

b) providing machine readable instructions for execution by said processing unit,

said instructions comprising instructions operating on said model in the following respects:

1) orientating said model with reference to a plane;

2) automatically determining local maxima of the model and areas bounded by said local maxima;

3) automatically determining saddle points between said local maxima in the model, said saddle points corresponding to boundaries between teeth;

4) determining the position of said saddle points along a dental archform, and

5) for each tooth, automatically identifying a path defining comprising a transition between teeth and gingival tissue and between adjacent teeth in said model and linking said saddle points, and identifying areas bounded by said path and in the direction away from said plane as corresponding to said gingival tissue.

7. The method of claim 6, wherein instructions 1) comprises instructions defining an occlusal plane or approximation thereof for the model and an approximate center of the model, and performing a transformation of said model to thereby orient said model with reference to said occlusal plane or approximation thereof and to said center.

8. The method of claim 6, wherein, in instructions 4), said archform comprises a parabolic archform of the form $y = ax^2 + b$, and wherein the method further comprises the step of performing a parabolic coordinate transform to thereby determine parabolic x coordinates for said saddle points.

9. The method of claim 6, wherein instructions 5) comprises instructions:

1) performing a directional ravine detection process testing for paths between saddle points with a concave curvature between two saddle points; and

2) delimiting an area bounded by said paths if said ravine detection process is successful.

10. The method of claim 6, wherein instructions 2), 3), 4) and 5) operate on a representation of said model comprising a continuous single surface formed of interconnected triangles defined by vertices.

11. In a system comprising a programmed computer containing instructions for separating virtual teeth from a virtual model of both teeth and gingival tissue, the improvement comprising:

providing instructions for execution by said programmed computer that

1) automatically determine local maxima of the model and areas bounded by said local maxima;

2) automatically determine saddle points between said local maxima in the model, said saddle points corresponding to boundaries between teeth;

3) automatically determine the position of said saddle points along a dental archform, and

4) for each tooth, automatically identifying a path interconnecting said saddle points for said tooth, said line or lines comprising a transition between teeth and

gingival tissue and between adjacent teeth in said model.

12. The improvement of claim 11, wherein said instructions 4) comprise instructions:

a) performing a directional ravine detection process testing for paths between saddle points with a concave curvature between two saddle points; and

b) delimiting an area bounded by said paths if said ravine detection process is successful.

13. In a system comprising a programmed computer containing instructions for separating virtual teeth from a virtual model of both teeth and gingival tissue, the improvement comprising:

providing instructions for execution by said programmed computer that identifies a path interconnecting saddle points between teeth, said path comprising a transition between teeth and gingival tissue and between adjacent teeth in said model, wherein said path is identified by performing a tree search tracing paths along a surface of said virtual model between said saddle points and selecting a path from said paths in said tree search based on a quality values assigned to said paths.

14. The improvement of claim 13, wherein said tree search is performed by reference to local curvature of said virtual model and a vector field for said model defining a direction of search for said path.